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मानक

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“Step Out From the Old to the New”

IS 6394 (2006): Ultrasonic Testing of Seamless Metallic Tubular Products by Contact and Immersion Methods - Code of Practice [MTD 21: Non-Destructive Testing]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

संपर्क और पद्धति द्वारा धात्विक नलिकाकार नमूनों
के पराश्रव्य परीक्षण — रीति संहिता

(दूसरा पुनरीक्षण)

Indian Standard

ULTRASONIC TESTING OF SEAMLESS METALLIC
TUBULAR PRODUCTS BY CONTACT AND
IMMERSION METHODS — CODE OF PRACTICE
(*Second Revision*)

ICS 77.040.20; 77.140.75

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FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Non-destructive Testing Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1971 and subsequently revised in 1986. This standard is intended to be a guide for the ultrasonic testing of seamless metallic tubular products by pulse-echo method. This has now been revised in the light of experience gained in this field.

In this revision, the following modifications have been carried out:

- a) Requirements of testing personnel, probes and couplant has been included; and
- b) Calibration of apparatus, procedure and test report requirements have been modified.

Indian Standard

ULTRASONIC TESTING OF SEAMLESS METALLIC TUBULAR PRODUCTS BY CONTACT AND IMMERSION METHODS — CODE OF PRACTICE

(*Second Revision*)

1 SCOPE

This standard covers procedures for detecting longitudinal and transverse (circumferential) discontinuities in seamless metal pipe and tubing using ultrasonic pulse-echo method by contact or immersion angle beam technique. It is intended to be used for tubular products having outside diameter greater than 12 mm, and having outer to inner diameter ratio less than 2.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
3664 : 1981	Code of practice for ultrasonic pulse-echo testing by contact and immersion methods (<i>first revision</i>)
13805 : 2004	Guidelines for certification of personnel for non-destructive testing

3 SURFACE CONDITION OF THE MATERIAL

The material to be inspected shall be free from scale, dirt, grease, paint or other foreign material that could interfere with interpretation or test results.

4 PERSONNEL

Personnel carrying out the ultrasonic inspection shall be qualified as per IS 13805.

5 EQUIPMENT

The instruments and accessory equipment shall be pulse reflection type with A-scan presentation and shall be capable of distinguishing the reference notches to the extent required in the calibration procedure.

6 PROBES

6.1 The probes should be free from internal noise and ringing which may interfere with the interpretation of the result.

6.2 The nominal frequency of the probe shall be in the range of 2 to 5 MHz unless variables such as production material or grain structure require the use of other frequencies to assure adequate penetration or better resolution. Shoes with appropriate curvature may be used, wherever necessary.

7 COUPLANT

A good liquid couplant such as water, oil or glycerin capable of transmitting ultrasonic vibrations between the transducer and the material being tested shall be used. The coupling medium shall be non-corrosive and adequate precautions shall be taken to ensure that any coupling medium which may be deleterious to the material or which may interfere with its subsequent processing is completely removed after completion of the test.

8 REFERENCE STANDARD

8.1 A reference specimen of a convenient length shall be prepared from a defect free length of pipe or tube identical in material, dimensions, surface finish and heat treatment to the product under inspection. Reference defects as described in 8.2 shall be introduced in this length of pipe or tube. The calibration pipe or tube shall be free of discontinuities producing indications that can interfere with detection of reference notches.

8.2 Longitudinal and transverse notches shall be introduced on the outer (OD) and inner (ID) surface of the reference standard. The notches shall be sufficiently separated from each other and from the ends of the tube to avoid mutual interference leading to difficulties in interpretation of reflected signals.

8.2.1 The acceptable notch configurations and dimensions to be measured are shown in Fig. 1.

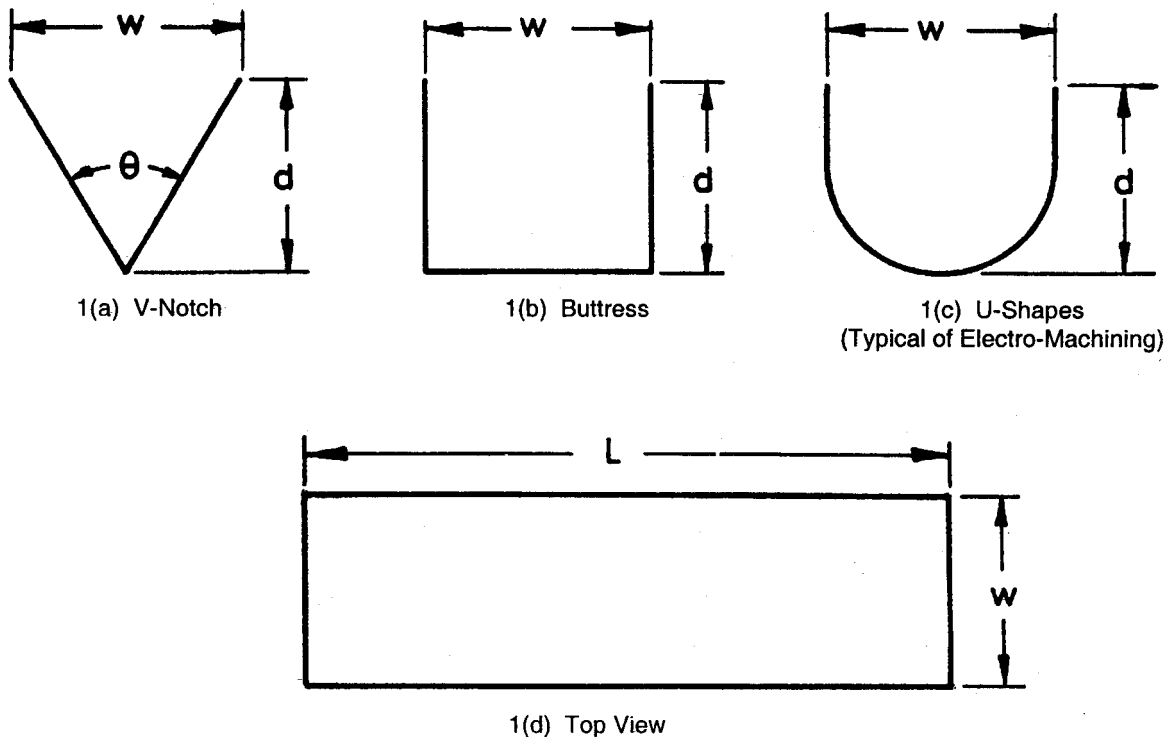


FIG. 1 COMMON NOTCH SHAPES

8.2.2 The dimensions of the artificial notches shall be as follows:

- Length* — 12.5 mm, 25 mm, 38 mm or 50 mm as agreed upon by the parties.
- Depth* — 3 percent, 5 percent, 10 percent or 12 percent of the nominal wall thickness (subject to a minimum of 0.3 mm) as agreed upon by the contracting parties. However, for critical applications a lower minimum limit can be agreed upon by the contracting parties.
- Width* — The width shall be as small as practicable, preferably in relation to the beam angle to be employed during inspection in order to get maximum reflected signal from the notch.
- Tolerance* — Tolerance on depth shall be ± 15 percent of the specified depth subject in the minimum of ± 0.05 mm, whichever is higher.

8.2.3 The notch depth shall be measured from the circular tubing surface to the deepest penetration of the notch.

9 CALIBRATION OF EQUIPMENT

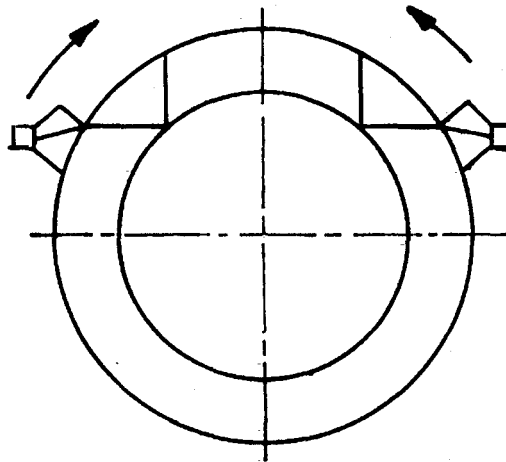
Using the reference standard specified in 8, the equipment shall be adjusted using suitable angle beam probe to produce readily distinguishable and clearly identifiable indications from both OD and ID notches.

The relative response from the inner and outer surface notches shall be as nearly equal as possible. The lesser of the two responses shall be used to establish the rejection level. However, on large diameter of heavy wall pipe and tubing, if the ID and OD surface notch amplitudes cannot be made equal because of large metal distance and inside diameter curvature then a separate rejection level may be established for the inner and outer surface notches.

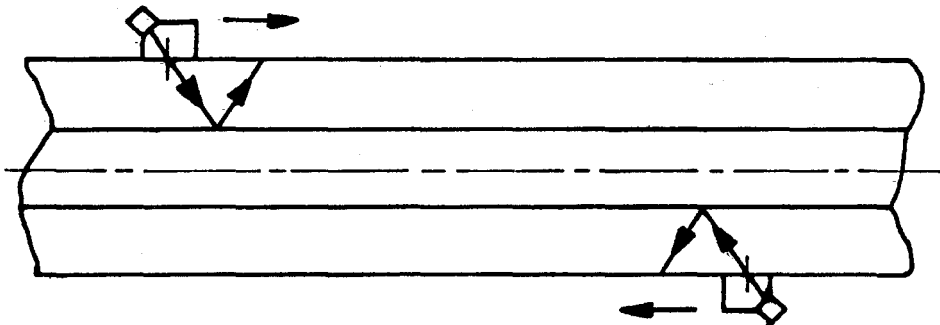
10 PROCEDURE

10.1 Scanning shall be carried out in two circumferential directions for detection of longitudinal defects and in the case of critical applications two axial directions also for detection of transverse defects as illustrated in Fig. 2(a) and Fig. 2(b) subject to the mutual agreement between the purchaser and the supplier. Testing is carried out by giving helical scan path on the outer surface of the tube. The speed of testing is kept constant within ± 10 percent. The pitch of the feed helix shall be small enough to ensure 100 percent coverage.

10.2 During manual operation, scanning shall be performed at a minimum gain setting of twice (+6 dB) the standard level though evaluation of any defect shall be done at the standard sensitivity level. For automated equipments in immersion testing, however, scanning shall be performed at the standard sensitivity level.



2(a) Circumferential Scanning in Two Directions



2(b) Axial (Longitudinal) Scanning in Two Directions

FIG. 2. SCANNING DIRECTIONS

10.3 Periodical checking of calibration shall be done by passing the reference standard. These checks shall be prior to any examination run and prior to equipment shutdown after an examination run. Recalibration is carried out whenever calibration is found disturbed and all the components tested after the previous calibration shall be rechecked.

11 RECORDING OF RESULTS

11.1 Any defect indication giving an echo amplitude less than the amplitude of the reference notch echo shall be accepted.

11.2 All indications giving an echo amplitude equal to or greater than the amplitude of the echo from the reference notch shall be rejected and recorded. Signals lower than the standards shall be considered as acceptable.

12 TEST REPORT

The following data should be recorded at the time of each test for future reference:

- a) Identification, material specification and dimensions of the tube/pipe;
- b) Condition of the surface of the tube/pipe;
- c) Reference sensitivity;
- d) Make and model of the test unit;
- e) Amplification or gain control of the equipment;
- f) Description of the probe;
- g) Couplant used;
- h) Mode of scanning;
- j) Ultrasonic indications and description of discontinuities;
- k) Certification level of the UT operator; and
- m) Date of testing.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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